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RESEARCH SUMMARY

October 1995 RS–023

forest sciences
NELSON FOREST REGION

Shelterwoods in Root Disease Infected Stands – Preliminary Results – EP 1186

By Deb Delong, Silvicultural Systems Research Forester

- **An interdisciplinary study looking at harvest methods, residual stand volumes, and root disease control**

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INTRODUCTION

In the summer of 1993, the Nelson Regional Forest Sciences section initiated a silvicultural systems trial as part of an investigation of partial cutting and root disease management. The trial has two locations, one in the Golden Forest District and one in the Arrow Forest District. The Golden site was harvested in the winter of 1995, and the Arrow site is scheduled for harvesting in the winter of 1996. The specific objectives of this trial are to:

1. demonstrate and compare the operational feasibility of harvesting small clearcuts and shelterwood cuts with conventional hand falling and mechanical pushover falling.
2. evaluate the short- and long-term success of pushover falling in ameliorating the effects of *Tomentosus* (Golden site) and *Armillaria* (Arrow site) root disease as compared to no treatment (conventional hand falling).
3. investigate the effects of these treatments on advance, post-harvest, and planted regeneration, vegetation development, root disease development, residual overstory growth, damage to residual overstory, coarse woody debris, soil disturbance, litter fall, decomposition rates, and visual quality.

This summary describes the Golden harvesting operation and provides preliminary post-harvest results.

SITE

The study site is located 4 km east of the town of Golden, B.C.on the Mount 7 Forest Service road in the Interior Cedar-Hemlock moist cool (ICHmk1)/ Montane Spruce dry cool (MSdk) subzone transition. Soils are predominantly silty loam and loam with calcareous parent material present at 40 to 60 cm depth. Slopes range from 5 to 35 %. The area is visible from the town of Golden and from the Trans-Canada highway.

Eight treatments were established in a 2 x 4 factorial design with two replicates, for a total of 16 one-hectare (100 x 100 m) blocks. The first factor is harvesting method and the second factor is level of basal area retention.

Treatments:

1. Conventional clearcut
2. Conventional light shelterwood (15 m^2)
3. Conventional heavy shelterwood (25 m^2)
4. Control (for conventional)
5. Pushover clearcut
6. Pushover light shelterwood (15 m^2)
7. Pushover heavy shelterwood (25 m^2)
8. Control (for pushover)

Before harvesting, inventories of stand structure, root disease, vegetation and woody debris were completed. All blocks were planted in the spring of 1995 with Douglas-fir, larch, and spruce.

Completed light shelterwood pushover block

Table 1. Pre-harvest stand characteristics (all blocks)

	layer 1 > 12.5cm dbh	layer 2 dbh 7.5cm to 12.5cm	layer 3 1.3m height to 7.5cm dbh	layer 4 <1.3m height
m3/ha	632	-	-	-
m2/ha	52	-	-	-
stems/ha	651	90	355	4100
avg dbh	34 cm	-	-	-
species	FdSe	Se(Fd)	SeBl	Fd(SeBl)

MARKING

All leave trees in the shelterwood blocks were marked prior to logging. Marking crews were asked to mark stands to a specific residual basal area (either 15 or 25 m2/ha) in order to achieve a uniform distribution of acceptable stems (healthy, good form, etc.), favouring Douglas-fir over spruce (Table 2). Markers used a combination of prism sweeps and target intertree distance to ensure they were approximating the target residual basal area.

Table 2. Post-harvest stand characteristics

	light shelterwood	heavy shelterwood
m^3/ha	164	291
m^3/ha	14.7	25.3
stems/ha	103	157
avg. dbh	42 cm	42 cm
species	Fd	Fd

HARVESTING OPERATION

Harvesting started mid-January 1995 and was completed by the first week of March 1995. A six-person crew worked a total of 37 days to remove 5200 m3 of volume. Snow depth on the blocks ranged from 20 to 35 cm during the harvesting.

Two International 58A skidders were used for skidding in the clearcut blocks and on the main trials. A John Deere 550 cat was used for skidding in the shelterwood blocks. An MDI YUTANI 200 excavator was used for pushover falling in two of the clearcuts, light shelterwood, and heavy shelterwood blocks. Main skid trails were located outside the blocks and were designated before harvesting. Random skidding was used inside the blocks.

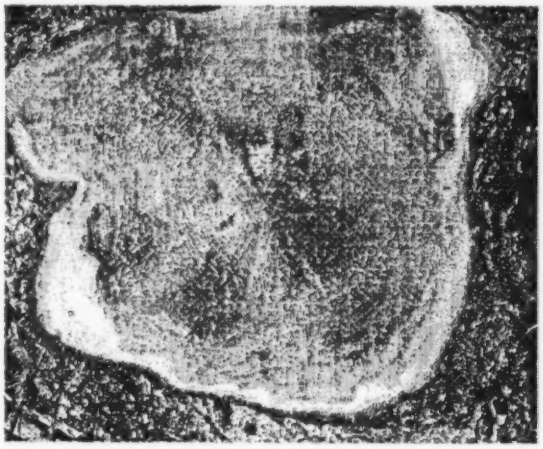
Pushover falling in both the light and heavy shelterwoods was not as difficult as anticipated. With some care and attention the excavator operator could successfully fall a tree directly adjacent to a leave tree. However, disturbance of leave tree root systems is a concern and blowdown is being monitored.

Excavator push-falling in a heavy shelterwood block

PRELIMINARY RESULTS

Root disease amelioration

The locations of *Tomentosus*-infected stumps were mapped in all the conventional harvest treatment units. This was done pre-harvest in the pushover blocks. These maps will be used to establish plots for assessing infection and mortality of both natural and planted regeneration. On the pushover blocks, trees will be planted beside stump holes for monitoring. As predicted by the pre-harvest root disease survey, there was considerable variation among treatment units in the prevalence of disease.



Inonotus tomentosus on spruce stump

Soil disturbance

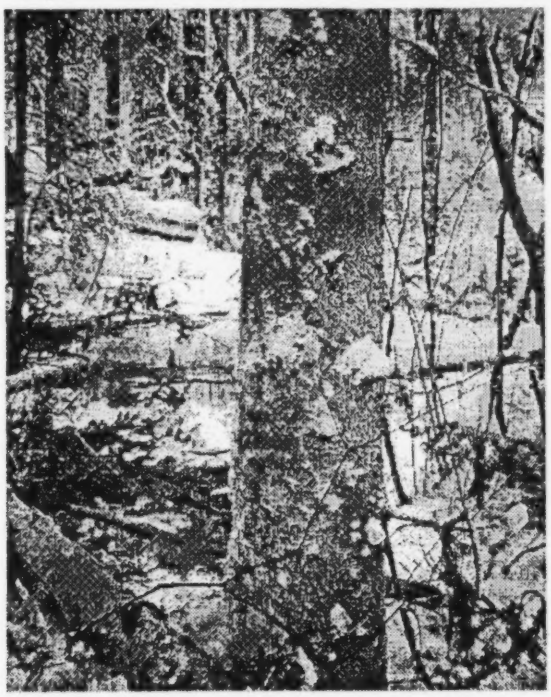
One of the objectives in the pre-harvest silviculture prescription (PHSP), was to leave the stumps in or near their original holes. This was required to keep the woody material on site, and to avoid large spot accumulations of stump debris on the block. Two steps were completed to meet this requirement. The excavator operator forwarded trees to the edge of the skid trail, where the buckerman cut off the stumps. The excavator then returned to the block and re-distributed the stumps out on the block. This

extra entry onto the site by the excavator caused extra site disturbance. In future operations the stump should be cut off at the original hole, before the stem is forwarded to the skid trail. This will be a requirement at the Arrow site.

Soil disturbance surveys will be completed by September 1995. The following observations have been made so far. Pushover blocks have greater soil disturbance than conventional blocks. On one of the pushover clearcut blocks, stump holes covered 35 % of the block's area. Some of these stump holes were equivalent to deep gouges, wide gouges, and wide scalps (i.e., detrimental disturbance). In general, soil disturbance levels decreased as basal area retained increased. The lowest soil disturbance levels were found on the conventional heavy shelterwoods and the greatest disturbance was found on the pushover clearcut blocks. Soil compaction was less than expected on all blocks due to winter logging conditions of frozen soils, and some snow pack.

Damage to overstory residuals

Injuries to residual trees were counted and characterized in each of the shelterwood treatment units. Similar levels of damage were found in the light and heavy shelterwoods, but damage tended to be more prevalent in the pushover blocks on average (21% compared to 12%). Damage by machinery (as opposed to falling damage) was the most common cause of injury. Most injuries gouged the wood to a depth of less than 1 cm, or exposed the phloem with- out gouging. The median injury area was 200 cm2, although 15% of the injuries were larger than 900 cm2, a size generally considered to result in significant decay. All injured trees have been mapped and the relationship between injury incidence and proximity to skid roads will be assessed. The assessment of decay that develops as a result of the injuries will begin in 15 years.



Mechanical damage to residual tree

Plantability

Plantability was lower on pushover blocks than on conventionally felled blocks. The decreased plantability was due to large amounts of buried or compacted woody debris. Plantability also decreased with basal area removed on the pushover blocks.

Damage to advance regeneration

Protection of advance regeneration wherever possible was a requirement of the harvesting operation. Pre-harvest surveys indicated an average of more than 4000 stems /ha of layer 3 and 4 regeneration (Table 1). Post-harvest surveys indicated that much less advance regeneration (7%) survived in the pushover blocks than in the conventional blocks (35%), regardless of silvicultural system. Within the same falling treatment, more regeneration survived harvesting in the shelterwoods than in the clearcut blocks.

Generally, the surviving advance regeneration was clumpy in distribution in all blocks. It is likely that if skid trails had been designated (inside each block), less regeneration would have been destroyed, and it would have been more evenly distributed. The shape (small and square) of the blocks resulted in more damage than would be expected for a larger block. Growth of advance regeneration as compared to planted trees is being monitored.

Herb and shrub response

Cover and height of herb and shrub species were greatly reduced on pushover blocks as compared to conventional and unharvested controls. Plant development stages (height and foliage growth) on pushover blocks also appeared to be delayed up to 2 months when compared to conventional blocks and controls. The cover of competing vegetation appears to decrease as the basal area retained increases. Thus, heavy shelterwood blocks should have the least problem with brush competition.

SUMMARY

Pushover falling in shelterwood and small patch cuts is operationally feasible and visually acceptable. However, pushover falling appeared to cause more damage to residuals, advance regeneration, and soils, as compared to conventional falling. Long-term biological feasibility, in terms of root disease development and tree growth, will not be known for a number of years.

Within the same falling treatment, the shelterwood prescriptions sustained less damage to residuals, regenera-

tion, and soils. This is likely due to the fact that less volume was taken out of the shelterwood prescriptions. The use of designated skid trails and larger block sizes without square corners would likely reduce damage in all blocks as well.

ONGOING RESEARCH

Research results from the various study components will be published as they become available.

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